P[actual = "blue"] = 0.2
P[actual = "yellow"] = 0.8

P[report = "blue" | actual = "blue"] = 0.8
P[report = "yellow" | actual = "blue"] = 0.2

P[report = "yellow" | actual = "yellow"] = 0.8
P[report = "blue" | actual = "yellow"] = 0.2

P[actual = "yellow" | report = "yellow"] = P[actual = "yellow"] * P[report = "yellow" | actual = "yellow"]

P[report = "yellow"]

P[report = "yellow"] = P[actual = "yellow"]*P[report = "yellow" | actual = "yellow"] +
P[actual = "blue"]*P[report = "yellow" | actual = "blue"]

= 0.2*0.8 + 0.8*0.2 = 0.32

P[actual = "yellow" | report = "yellow"] = 0.2*0.8 / 0.32 = 0.5

P[emails are spam] = 0.4
P[emails are not spam] = 0.6

P[word = "checkout" | email is spam] = 0.01
P[word = "checkout" | email is NOT spam] = 0.004

P[email is spam | word = "checkout"] = P[email is spam] * P[word = "checkout" | email is spam] / P[word = "checkout"]

P[word = "checkout"] = P[email is spam]*P[word = "checkout" | email is spam] +

P[email is not spam]*P[word = "checkout" | email is NOT spam]
= 0.4*0.01 + 0.6*0.004 = 0.0064

P[email is spam | word = "checkout"] = 0.4 * 0.01 / 0.0064 = 0.625

P[majority-blue] = 1/2
P[majority-red] = 1/2

P[ball picked is "blue" | urn is "majority-blue"] = 2/3
P[ball picked is "red" | urn is "majority-blue"] = 1/3

P[ball picked is "red" | urn is "majority-red"] = 2/3
P[ball picked is "blue" | urn is "majority-red"] = 1/3

P[urn is majority-blue | ball picked is blue]
= P[urn is majority-blue] * P[ball picked is blue | urn is majority blue] / P[ball picked is blue]

P[ball picked is blue] = P[urn is majority-blue]* P[ball picked is "blue" | urn is "majority-blue"] +
P[urn is majority-red] * P[ball picked is "blue" | urn is "majority-red"]

= 1/2 * 2/3 + 1/2 * 1/3 = 1/2

P[urn is majority-blue | ball picked is blue] = 1/2 * 2/3 / 0.5 = 2/3

P[urn is majority-blue | balls picked are blue,blue, red]
= P[urn is majority-blue] * P[balls picked are blue, blue,red | urn is majority-blue] / P[balls picked are blue,blue,red]

P[balls picked are blue, blue,red | urn is majority-blue]
= P[ball picked is blue | urn is majority-blue] *
P[ball picked is blue | urn is

majority-blue] *
P[ball picked is red | urn is majority-blue]
= 2/3*2/3*1/3 = 4/27

P[balls picked are blue, blue,red | urn is majority-red] = 1/3*1/3*2/3 = 2/27

P[balls picked are blue, blue, red] = 1/2*4/27 + 1/2* 2/27 = 1/2*6/27 = 1/9

2/27 / 1/9 = 2/3

P[see "blue" | hypothesis is "majority-blue"] - high signal (q) > 1/2
P[see "red" | hypothesis is "majority-blue"] - low signal (1-q)

P[see "red" | hypothesis is "majority-red"] - low signal (q) > 1/2
P[see "blue" | hypothesis is "majority-red"] - high signal (1-q)

S = sequence of 'a' high signals and sequence of 'b' low signals

P[majority-blue | S] = P[majority-blue] * P[S | majority-blue] / P[S]
P[S] = P[majority-blue] * P[S | majority-blue] + P[majority-red]*P[S | majority-red]
= p*q^a *(1-q)^b + (1-p)*(1-q)^a * q^b

P[majority-blue | S] = p*q^a *(1-q)^b
----
p*q^a *(1-q)^b + (1-p)*(1-q)^a * q^b

a > b

Since q > 1/2

q^a *(1-q)^b > (1-q)^a q^b

p*q^a *(1-q)^b + (1-p)*(1-q)^a * q^b < p*q^a *(1-q)^b + (1-p)*q^a *(1-q)^b

1/() > 1/()

P[majority-blue | S] > p

--

a < b

P[majority-blue | S] =   p*q^a *(1-q)^b

----
                          p*q^a *(1-q)^b + (1-p)*(1-q)^a * q^b

q^b * (1-q)^a > q^a * (1-q)^b

b > a

p*q^a *(1-q)^b + (1-p)*(1-q)^a * q^b > p*q^a *(1-q)^b + (1-p)*q^a * (1-q)^b

1/() < 1/()

< p